

Recovery Efforts

Non-Native Species Monitoring and Control Fiscal Year 2002 Workplan Proposal

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Background:

During 1991-1997, nonnative species studies on the San Juan River focused on the identification of impacts to native fishes. Research characterized the distribution and abundance of non-native species in main channel habitats, seasonal movements of channel catfish and common carp, the food habits of non-native predators, primarily channel catfish, the overlap of resource use between native and non-native fish species, and the relation of these findings to differing flow regimes. Channel catfish were the single most abundant large non-native predator in main channel collections. Data indicated that channel catfish occupied a variety of habitats within the main channel, generally exhibited localized movement, and at lengths > 450 mm TL preyed upon native species.

The emphasis of removal of channel catfish and common carp was placed on a portion of Reach 6 (PNM weir to Hogback Diversion) and was designed to address removal or minimization of the reproductive effort in the upper portion of the species' occupied range. Mechanical removal efforts employed during 1998-2000 removed more than 8,000 channel catfish and 5,000 common carp. Analyses of 1998-2000 data illustrated the decline in the abundance of channel catfish > 300 mm TL, presumably due to removal efforts, throughout the study area. Common carp, on the other hand, did not change in distribution and abundance or size class structure.

Given the popularity of channel catfish as a sport fish and the concerns expressed by the public regarding disposal of removed fish, a program to transplant removed fish to isolated fishing impoundments was initiated in 1998 and continued through 2000. Channel catfish were removed by raft-mounted electrofishing gear and transplanted by State of New Mexico hatchery truck to closed impoundments managed for recreational fisheries. This effort was strongly supported by the State of New Mexico and the local public.

Other nonnative species are also a major concern during removal efforts, particularly with recent survey results. Electrofishing surveys in the San Juan River during 2000 identified the widespread distribution and high abundance of striped bass during post runoff upstream as far as the PNM weir. Autumn surveys indicated that striped bass did not persist in the San Juan River upstream of Lake Powell, likely an artifact on increasing water temperature and turbidity. This species poses a substantial threat to native San Juan River fishes through predative impacts and necessitates increased removal efforts.

This workplan proposes to continue mechanical removal of channel catfish and other non-native species by raft-mounted electrofishing. Monitoring data on the distribution, abundance, and food habits of non-native species will be collected and analyzed. The size at sexual maturity for channel catfish in the San Juan River will be evaluated by examination of reproductive organs from all size classes encountered. Data analyses of channel catfish abundance in collections and capture rate by size class will be employed to identify target catch per unit effort by size class. Sustained attainment of a target catch per unit effort in upstream reaches will be used to trigger a shift in removal emphasis to the next downstream reach. Transplantation of San Juan River channel catfish to isolated impoundments currently used for recreational fisheries will be continued.

Objectives:

- 1.) Continue data collection and mechanical removal of non-native species during main channel adult rare fish monitoring efforts.
- 2.) Evaluate distribution and abundance patterns of non-native species to determine effects of mechanical removal on abundance and distribution patterns.
- 3.) Continue transplantation of channel catfish to fishing impoundments isolated from the San Juan River.
- 4.) Characterize the distribution and abundance of striped bass into the San Juan River upstream of Lake Powell during removal efforts and determine predative impacts via stomach content analysis.
- 5.) Relate size of channel catfish to sexual maturity for use in development of a specific target objective for removal efforts.
- 6.) Develop catch per unit effort targets for use in evaluation of mechanical removal in discrete river reaches.

Methods:

Mechanical removal will continue during the fall main channel monitoring efforts. During these sampling efforts, all nonnative species collected will be sacrificed and data recorded for species identification and enumeration, ontogenetic stage (young-of-year, sub-adult, adult) at non-designated miles, and standard and total lengths and weight at designated miles. Data will be summarized by geomorphic reach and sampling will occur two out of every three river miles. Data for recaptured channel catfish and common carp tagged during 1993-1996 will be recorded in the field and integrated into existing databases for movement and abundance. Catch per unit effort (CPUE) will be calculated as number of fish collected per minute electrofishing time and be calculated for the total collection and for each species. Analyses will include comparison to 1991-2000 data summaries.

A minimum of six sampling trips for mechanical removal in the San Juan River reach between PNM Weir and Hogback will occur weekly, February-March 2002. Each sampling trip effort will be three consecutive days of repetitive removal from the removal reach. Monthly removal efforts will be employed during June, July, August, September and December. Sampling will be by two electrofishing rafts and captured channel catfish will be measured (nearest 1 mm) for standard and total lengths, weighed (nearest 1 g), and, if not sacrificed for study purposes, transported by hatchery truck to isolated recreational angling impoundments in the Four Corners region. All other nonnative species sampled during these efforts will be sacrificed and appropriate data recorded for location, length/weight, and, for lacustrine predators, stomach contents. Total and individual daily CPUE will be calculated to evaluate efforts of short-term suppression efforts to locally deplete nonnative species numbers.

A minimum sample of 500 channel catfish will be analyzed for development status of reproductive organs. Specimen standard and total lengths (nearest 1 mm), weight (nearest g), sex, method of capture, location (RM), and date will be recorded. The suggestions of Lagler (1956) will be followed for determination of the maturity and state of sexual organs. Sexual organs will be classified as immature (no eggs or milt evident), ripe (eggs and milt grossly evident), or spent (ovaries or testes involute) for the suspected spawning season (April - August) and as immature (no eggs or milt evident) and mature (eggs or milt apparent) the remainder of the year. The length frequency for specimens with mature reproductive organs will be determined to characterize the relationship between size and sexual maturity.

Striped bass control efforts will be combined with other mechanical removal efforts unless high abundance and distribution patterns observed post spring runoff 2000 are encountered during 2001 and 2002. If it is determined that abundance and distribution are high, based upon spring sampling for both mechanical removal efforts and razorback sucker monitoring, specific removal efforts will be employed between Farmington, New Mexico and Bluff, Utah. Two sampling efforts during July and August after cessation of high flows will be employed, using three electrofishing rafts. All nonnative fishes will be removed. Lacustrine non-native species (primarily striped bass, walleye, largemouth bass) collected in the San Juan River will be sacrificed for stomach content analysis and determination of gender and reproductive status. Stomachs will be removed from each specimen captured and preserved in 10% formalin for lab analyses. Data recorded for each specimen are date, location (RM segment), species, standard and total lengths (nearest 1 mm), weight (nearest 1 g), and sex. Stomach content analyses will identify frequency of occurrence and weight by individual prey species, stomach fullness and relate standard length of identifiable prey species to predator standard length.

Catch per unit effort (CPUE) data will be analyzed for two size classes (adult >300 mm TL, immature < 300 mm TL) of channel catfish to monitor and evaluate changes relative to removal efforts. The objective is to develop a target CPUE for each size class and allow for a shift in removal efforts to the next downstream river reach, once the target is obtained. The target CPUE for channel catfish is currently unknown and will be based upon historic CPUE values for channel catfish and current sampling efforts during 2001. Identification of statistically defensible target CPUE using data through 2001 and attainment of the target CPUE may result a decision to relocate intensive removal efforts to the next stream segment downstream (Hogback Diversion to Shiprock Bridge). A minimum of two removal efforts in the PNM Weir to Hogback

Diversion would occur during 2002 to continue suppression of extant channel catfish and maintenance at or below the target CPUE.

Deliverables:

Participation will continue in data integration efforts to incorporate 1998-2001 data, produce a summary report, refine flow recommendations as appropriate, and complete revision of SJRRIP planning documents . An electronic data file will be provided for inclusion in the centralized database by 31 March 2003. A summary report detailing findings will be completed in draft by 31 March 2003 for SJRIP Biology Committee review and finalized by 1 June 2003.

Budget (FY-2002):

Personnel:

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| Nonnative species removal/channel catfish translocation (168 mandays) | \$ 58,700 |
| Laboratory processing of samples (11 mandays) | \$ 3,900 |
| Reporting/data management (40 mandays) | \$ 13,900 |

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| Subtotal | \$ 76,500 |
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Travel/per diem:

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| Removal/translocation (113 days) | \$ 8,500 |
| Reporting/data management (12 days) | \$ 900 |

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| Subtotal | \$ 9,400 |
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Equipment and supplies

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| Removal/translocation (generator replacement, equipment maintenance) | \$ 5,000 |
| Laboratory (preservatives, containers, dissecting instruments) | \$ 300 |
| Reporting/data management (administrative supplies) | \$ 1,500 |

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| Subtotal | \$ 5,800 |
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| TOTAL | \$ 91,700 |
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| Administrative Overhead (20%) | \$ 18,340 |
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Funding for participation of other agencies:

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| New Mexico Department of Game and Fish - Santa Fe | \$ 10,000 |
| U.S. Fish and Wildlife Service - Grand Junction | \$ 5,000 |
| Utah Division of Wildlife Resources - Moab | \$ 5,000 |

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| GRAND TOTAL | \$ 130,040 |
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Outyear Funding:

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| Fiscal Year 2001 | \$ 117,240 |
| Fiscal Year 2003 | \$ 133,940 |
| Fiscal Year 2004 | \$ 137,660 |
| Fiscal Year 2005 | \$ 141,790 |
| Fiscal Year 2006 | \$ 146,040 |
| Fiscal Year 2007 | \$ 150,420 |

Non-Natives Species Removal in the Lower San Juan River Fiscal Year 2002 Project Proposal

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Background:

Introductions of non-native fish species into the Upper Colorado River Basin have created a difficult problem. Non-native species prey upon and compete with native species, resulting in the decline of the native population. Large predacious species introduced as sport fish into reservoirs have increasingly made their way into the riverine habitat that has historically been the domain of the native fish. Northern pike, walleye, largemouth bass, and sunfish are examples of sport fish that have been found in the Green and Colorado rivers.

In 1995 mechanical removal efforts were initiated by the U.S. Fish and Wildlife Service to target non-native species in the San Juan River. Channel catfish were the main focus of these removal efforts, as they occupy a variety of habitats within the main channel, and at larger sizes prey on the native fish community. Data from 1998-2000, collected by USFWS, has shown a decline in the abundance of channel catfish > 300 mm TL in the study area, presumably due to removal actions. Removal efforts continue to take place in a nine mile portion of Reach 6 between the Hogback Diversion Dam and the PNM Weir.

Other non-native species are a concern due to their impact on native species in the San Juan River. Several lacustrine predators are free to move up into the San Juan River from Lake Powell. These include largemouth bass, walleye and striped bass (stripers). Recently, striped bass from Lake Powell have become an issue in the San Juan River. Lake Powell has a large population of striped bass and their life history patterns suggest that they move out of lakes and into lotic waters to spawn in the spring (Lee et al. 1980). Furthermore, their effectiveness as visual predators is likely increased during clear flowing runoff periods. Widespread abundance and distribution of striped bass was observed in July 2000 during electrofishing surveys on the San Juan River. Surveys in the fall of 2000 indicated lower numbers of stripers than had been found previously, but some individuals persisted into October. Electrofishing surveys in 2001 have once again documented the presence of striped bass in the river (Dale Ryden, pers. comm.). The likelihood of stripers preying upon native and endangered fish poses a particular threat to the recovery of endangered species in the San Juan River. The consistent observation of this species in the San Juan River suggests the need for further study and associated removal efforts to protect the native and endangered fish community in the river.

This workplan proposes to identify when the majority of striped bass tend to move up into the San Juan River, in addition to actively removing them and other non-natives in the lower section of river. This project is an exploratory effort that will serve to determine what time frame will be

most effective so that more intensive and specific efforts may be implemented through a long-term removal/control program in the future. Removal efforts in the lower river will aid in current efforts further upstream, and hopefully suppress any negative impacts to the endangered and native fish community.

Objectives:

- 1.) Determine when striped bass move out of Lake Powell and into the San Juan River.
- 2.) Initiate mechanical removal efforts of large bodied non-native species in the lower portion of the San Juan River.
- 3.) Relate striped bass movement out of Lake Powell into the San Juan River to lake levels and river conditions (including flows and turbidity).
- 4.) Characterize the distribution and abundance of lacustrine predators moving out of Lake Powell into the San Juan River during spring and summer.

Study Area:

The study area for this project includes the San Juan River from Mexican Hat (RM 53) to Clay Hills (RM 2.9), Utah. The river from Mexican Hat to RM 17 is part of Geomorphic Reach 2 and is primarily bedrock confined and dominated by riffle-type habitat. RM 17 down to Clay Hills includes Geomorphic Reach 1 where the river is canyon bound with an active sand bottom. Habitats within this section are heavily influenced by the shifting thalweg, changing river flow, and reservoir elevations.

Methods:

Mechanical removal of non-native species will be conducted from Mexican Hat to Clay Hills, Utah. Sampling efforts will be conducted via two raft mounted electrofishing boats. The entire study area will be electrofished in a downstream fashion with one boat on each shoreline. Each boat will have one netter and one rower. A total of 10 trips is anticipated, beginning in March and continuing through October. Bi-weekly trips will be conducted around peak flows during spring run-off, which will likely translate to every other week sampling in May, June, and July. In addition, an eleventh trip will be conducted as a part of the annual fall monitoring effort in late-September/early-October. This schedule should allow for sampling of a variety of habitat conditions, including variable flows and turbidity.

All non-natives collected will be identified, enumerated, measured to the nearest mm for total and standard length, weighed to the nearest gram, and removed from the river. Gender and reproductive status of lacustrine species will be determined and approximate location of capture by river mile recorded. Stomachs of lacustrine species will be taken for later analysis by USFWS-Albuquerque to determine predation on rare and other native fish species. Any rare fish encountered will be collected, identified, enumerated, measured to the nearest mm for total and standard length, weighed to the nearest gram, and scanned for a PIT tag. If a PIT tag is not

present one will be inserted. General condition of the fish will be recorded in addition to any parasites or abnormalities. All rare fish collected will be returned to the river. Other native fish will not be netted. Catch rates will be calculated as number of fish caught per hour and river miles will be recorded for approximate collection locality.

General water quality parameters will be recorded including temperature, conductivity, salinity, and dissolved oxygen. Daily water discharge and turbidity will be compared to catch rates for striped bass to determine the relationship between river conditions and movement of these fish upstream.

Costs for other cooperating agencies that may provide personnel and equipment as needed are included in this budget.

Deliverables:

A draft report for the Non-Native Species Removal in the Lower San Juan River activities will be prepared and distributed to the San Juan River Biology Committee for review by March 2003. Historical information on nonnative fish species' use of the lower San Juan River will be included, to the extent it is available. Upon receipt of written comments, the report will be finalized and forwarded to members of the San Juan River Biology Committee 1 June 2003. Electronic copies of the field and collection data will be transferred to the San Juan River database manager following the successful protocol previously employed.

Budget FY-2002:

| Personnel: | UDWR | USFWS/NMGF |
|------------------------------|------------------|------------|
| Biologists (60 days) | \$ 12,000 | \$ 12,000 |
| Technicians | \$ 11,000 | |
| Project Leader | \$ 2,400 | |
| Travel/per diem: | \$ 4,000 | \$ 1,000 |
| Data Analysis and Reporting: | \$ 5,000 | |
| Equipment and Supplies: | | |
| Raft Mounted Electrofisher | \$ 10,000 | |
| Misc. | \$ 1,000 | |
| Subtotal | \$ 45,400 | \$ 13,000 |
| Administrative Overhead | | |
| UDWR (20%) | \$ 9,080 | |
| USFWS/NMGF | | \$ 2,340 |
| Total | \$ 54,480 | \$ 15,340 |
| Grand Total | \$ 69,820 | |

Budget FY-2003:

| Personnel | UDWR | FWS/NMGF |
|-----------------------------|------------------|-----------|
| Biologists (60 days) | \$ 12,600 | \$ 12,600 |
| Technicians | \$ 11,550 | |
| Project Leader | \$ 2,520 | |
| Travel/per diem | \$ 4,200 | \$ 1,050 |
| Data Analysis and Reporting | \$ 5,250 | |
| Equipment and Supplies | | |
| Misc. | \$ 2,000 | |
| Subtotal | \$ 38,120 | \$ 13,650 |
| Administrative Overhead | | |
| UDWR (20%) | \$ 7,624 | |
| FWS/NMGF | | \$ 2,730 |
| Total | \$ 45,744 | \$ 16,380 |
| Grand Total | \$ 62,124 | |

References:

Lee, David S., C. R. Gilbert, C. H. Hocutt, R.E. Jenkins, D. E. McAllister, J. R. Stauffer, Jr.1980. Atlas of North American Freshwater Fishes. North Carolina State Museum of Natural History.

Razorback Sucker Augmentation Fiscal Year 2002 Project Proposal

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Background:

Razorback sucker are native to the San Juan River. At present this species is extremely rare in the San Juan River. In order to gain information on habitat use, possible spawning areas, and survival and growth rates of hatchery-reared razorback sucker in the wild, it was necessary to experimentally stock a small number of fish. Experimental stocking of razorback sucker into the San Juan River began in 1994, as was outlined in An Experimental Stocking Plan For Razorback Sucker In The San Juan River. Between 1994 and 1996, a total of 939 razorback sucker were stocked into the San Juan River by personnel from the U.S. Fish and Wildlife Service's (Service) Colorado River Fishery Project (CRFP) office in Grand Junction, Colorado. All 939 were progeny of paired matings between San Juan River arm of Lake Powell adults. All fish were PIT-tagged before release into the wild. In March 1994, 15 razorback sucker were divided and stocked in equal numbers at river mile (RM) 136.6, 117.5, and 79.6. Between 27 October and 18 November 1994 and additional 671 razorback sucker were stocked in roughly equal numbers at these same three stocking sites and at Hogback Diversion (RM 158.6). On 27 September 1995, 16 razorback sucker were stocked at Hogback Diversion. The last stocking associated with this study occurred on 3 October 1996, when 237 razorback sucker were stocked at Hogback Diversion. Based on the success of this experimental stocking study the decision was made to implement a full-scale augmentation program for razorback sucker in the San Juan River. Information obtained during the evaluation of stocked razorback sucker will help address objectives 5.1 through 5.5 in the San Juan River Long Range Plan.

In August 1997, a Five-Year Augmentation Plan for Razorback Sucker in the San Juan River was finalized. The five-year augmentation plan, recommended the stocking of 64,618 razorback sucker into the San Juan River between 1997 and 2000. Stocking of razorback sucker from various sources into the San Juan River began in early September 1997. However, between 3 September 1997 and 20 October 2000 a total of only 5,208 razorback sucker were stocked into the San Juan River (Table 1). If razorback sucker stocked as part of the experimental stocking plan (1994-1997) are included, 6,147 razorback sucker have been stocked into the San Juan River since 1994. The 5,208 razorback sucker stocked as part of the five-year augmentation effort represents a shortfall of 59,410 fish when compared to numbers recommended in the five-year augmentation plan to date.

The inability to achieve San Juan River razorback sucker augmentation goals has been due to a suite of circumstances all of which ultimately result in a lack of fish. Rearing facilities outside of the San Juan River Basin lack the capabilities to continue to hold and rear razorback sucker for

the San Juan River Recovery Implementation Program (SJ RIP). Given this lack of resources, efforts were undertaken to develop and establish rearing facilities (grow-out ponds) within this basin thereby affording self-sufficiency to the San Juan River razorback sucker augmentation program.

Table 1. A summary of razorback sucker stocked into the San Juan River as part of the five-year augmentation plan. All stocked fish were PIT-tagged before being released into the wild.

| DATE | NUMBER | SIZE | RELEASE LOCATION | PARENTAL STOCK |
|---------------------------|--------|-------------------|-------------------|--|
| 3 SEP 1997 | 1,027 | JUVENILE | Hogback Diversion | Lake Mohave |
| 17 SEP 1997 | 227 | JUVENILE | Hogback Diversion | Green River X Yampa River |
| 19 SEP 1997 | 1,631 | JUVENILE | Hogback Diversion | Colorado River or Colorado River Arm of Lake Powell X Etter Pond |
| 22 APR 1998 & 28 May 1998 | 124 | JUVENILE | Hogback Diversion | Green River |
| 14-15 OCT 1998 | 1,155 | JUVENILE | Hogback Diversion | Lake Mohave |
| 17-20 OCT 2000 | 1,044 | JUVENILE & ADULTS | Hogback Diversion | Lake Mohave Green & Colorado Rivers |
| TOTAL | 5,208 | | | |

As stated above, the number of excess razorback sucker currently available to the SJ RIP from Upper Colorado River Basin (UCRB) recovery efforts will not be sufficient to make up current shortfalls and achieve the goals prescribed in the five-year augmentation plan. The approach currently being employed to address shortfalls is to obtain razorback sucker larvae from Willow Beach and Dexter National Fish Hatcheries (NFH). Razorback sucker held at these hatcheries are progeny of wild Lake Mohave adults. Since the majority of these larvae are produced in March, they will need to be temporarily retained until food availability and water temperatures are adequate in the holding ponds to support them (usually mid- to late-May).

Personnel Division of Fishes, Museum of Southwestern Biology (MSB), at the University of New Mexico (UNM) have addressed this concern (under a separate workplan) by establishing temporary holding facilities for larval razorback sucker. The holding facility will serve to maintain larvae in the interim (8-10 weeks) between their being obtained from hatchery facilities and a time when water temperatures at holding ponds increases to a level sufficient for rearing of

larvae. UNM personnel are currently using this system to raise approximately 52,000 razorback sucker that were obtained from Willow Beach and Dexter NFH in spring 2001.

Description of Study Area:

Larval razorback sucker obtained from Willow Beach and Dexter NFH in spring 2002 will be transported to interim rearing facilities at the University of New Mexico. The UNM rearing facility is sufficient to hold and rear approximately 50,000 larval razorback sucker for a period of between 6-10 weeks. Water temperature information acquired from holding ponds (Ojo and Avocet) during previous years, suggest that by May, water temperatures will have achieved a sufficient level to sustain larval razorback sucker. These data indicate that the interim holding facilities should be prepared to accommodate larvae for at least 6 and up to 10 weeks. The goal will not be to hold larval fish in the interim facility for a pre-determined time period but instead to establish them in grow-out ponds as soon as conditions allow.

Razorback sucker will be reared in grow-out ponds for two full growing seasons (to TL > 300 mm), at which time they will be harvested, PIT-tagged and stocked into the San Juan River just downstream of the Hogback Diversion (RM 158.6), between Farmington and Shiprock, New Mexico.

The study area for the monitoring of razorback sucker stocked into the San Juan River extends from RM 158.6 downstream to RM 76.4 (Sand Island boat landing) near Bluff, Utah.

Objectives:

- 1.) Transfer reared larval razorback sucker from MSB to grow-out ponds (CRFP)
- 2.) Maintenance of holding ponds (BIA-NIIP)
- 3.) Harvest razorback sucker from ponds, PIT tag, and stock fish downstream of Hogback Diversion (CRFP, BIA-NIIP)
- 4.) Monitor spawning season habitat use and movement patterns of hatchery-reared razorback sucker in the wild (CRFP)
- 5.) Monitor survival rates and growth rates of hatchery-reared, known-age razorback sucker in the wild (CRFP)
- 6.) Determine whether hatchery-reared razorback sucker will recruit into the adult population and successfully spawn in the wild (CRFP, MSB)
- 7.) Produce a three-year integration report for field work performed from 1999-2001. Produce an interim progress report for results and findings of razorback sucker monitoring field work performed in 2002 (CRFP)

Methods:

CRFP personnel will coordinate the obtaining of larval razorback sucker from Willow Beach and Dexter NFH during March and April 2002. Larval razorback sucker obtained from hatchery facilities will be transferred to the interim rearing facility at MSB with handling and transport following existing U. S. Fish and Wildlife Service protocols. Under a separate workplan, growth and survival will be tracked during the rearing tenure at MSB. CRFP personnel will determine when it is appropriate to transfer larval razorback sucker from the interim MSB holding facilities to grow-out ponds (presumably May to June). This transfer and disposition of larvae will be determined and coordinated by CRFP personnel with the assistance of MSB personnel.

Larval razorback sucker will be reared at grow-out ponds for two full growing seasons. Maintenance of water level and monitoring of pond water quality will be performed by BIA-NIIP personnel. Additional razorback sucker larvae may also become available as excess fish are culled from lots being produced for augmentation efforts in the UCRB. If this is the case CRFP personnel will transport these fish to the appropriate holding pond. In the fall, razorback sucker > 300 mm TL will be harvested using fyke nets, trammel nets, or other appropriate gear, PIT-tagged, and stocked into the San Juan River downstream of Hogback Diversion (RM 158.6).

Stocked fish will be monitored on two electrofishing/netting trips in 2002. Both trips will sample from RM 158.6-76.4. The spring sampling trip will occur before runoff begins, in late March or early April. The summer trip will occur after the hydrograph has returned to summer base flows. Electrofishing, seining, and trammel netting will be used to determine dispersal, and survival of stocked fish. The fall 2002 main channel fish community monitoring (i.e., long-term monitoring) trip will act as a third trip to monitor stocked razorback sucker throughout the year. Survival rates will be determined using either mark-recapture models (e.g., Program CAPTURE, MARK, Schnabel, Petersen) or age/growth curves or a combination of the two. Electrofishing and handling of rare fish species will follow the protocol found in the main channel fish community monitoring workplan, except that electrofishing will be done every mile, instead of 2 out of every 3 miles and only data on rare fish species collected (i.e., razorback sucker, Colorado pikeminnow, and roundtail chub) will be recorded. When rare fish species are collected, PIT tag number, length, weight, reproductive status (if evident), and information about health abnormalities (if any) will be recorded.

In support of Objectives 4 and 6, up to eight razorback sucker will be implanted with radio transmitters (one-year lifespan) on the fall 2001 main channel fish community monitoring trip. These fish will be tracked throughout the suspected spawning season for razorback sucker in the San Juan River (i.e., late February through early June). Tracking trips will be conducted on a monthly basis (minimum of four trips) from the last week of February to the first week of June. If spawning aggregations of razorback sucker are identified, trips will be done on a more frequent basis, concentrating on the spawning fish. Fish contacted during radio tracking trips will be tracked for a minimum of one hour each. At the end of the contact, all riverine habitats for 100 meters both up- and downstream of the most up- and downstream fish locations during the contact period will be mapped on hardcopies of aerial videography. All habitats utilized by the fish will be recorded as well as the amount of time spent in each particular habitat type. Once back from the field, relative percentages of habitats available and habitats used will be

determined, so that habitat selection can be determined as in previous razorback sucker telemetry studies on the San Juan River. During radiotelemetry contacts, detailed habitat information on substrate, depth, cover, and velocity at the fish's most frequented location will also be recorded. Water quality parameters including dissolved oxygen, water temperature, conductivity, and pH will be measured at each contact location. At the end of a radio telemetry contact, attempts will be made to recapture radiotelemetered fish via trammel netting and/or seining. Recapture efforts will be aimed at gaining data on age, growth, and sexual status as well as trying to recapture any other razorback sucker that might be aggregating with radiotelemetered fish. If spawning aggregations of razorback sucker are identified, crews from other research elements monitoring razorback sucker larval drift (i.e., Steven Platania) and habitat quality and quantity (i.e., Ron Bliesner and Vince Lamarra) will be notified.

Mechanical removal of nonnative fish species will continue to take place on all razorback sucker monitoring trips.

The Service (CRFP) will have the lead for the razorback sucker monitoring with the New Mexico Department of Game and Fish providing field personnel and equipment for monitoring trips. Other cooperating agencies will provide personnel and equipment for these trips as needed.

Products:

A draft three-year synthesis report analyzing data collected from 1999-2001 will be completed by 30 March 2002. A "draft final" of this report incorporating comments received will be completed by 1 June 2002. An interim progress report for razorback sucker monitoring trips conducted in 2002 will be completed by 31 March 2003. A "draft final" incorporating all comments received will be completed by 1 June 2003. DBASE IV files containing information on total catch and length/weight data gathered for rare fish species will be submitted to Keller-Bliesner Engineering for inclusion on the SJRIP integrated database CD-ROM by 31 March 2003.

Budget – FY 2002:**Personnel**

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| Objectives 1 and 3 (42 man days): grow-out pond work | \$ 8,616 |
| Objective 4 (40 man days): radio telemetry | \$ 8,208 |
| Objectives 4, 5 and 6 (35 man days): electrofishing | <u>\$ 7,176</u> |
| Subtotal | \$ 24,000 |

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| Travel and Per Diem (24 days) | \$ 5,000 |
| Data Analysis and Reporting (30 days) | <u>\$ 6,000</u> |
| Subtotal | \$ 11,000 |

Equipment and Supplies--i.e., maintenance, repair, replacement of:

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| Field equipment: stocking truck, water pump, nets, PIT tag gear, rafts and jon boats, outboard motors, radio receivers, etc. | <u>\$ 3,000</u> |
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| Total | \$ 38,000 |
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| Service Administrative Overhead (20.00%) | <u>\$ 7,600</u> |
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| U.S. Fish and Wildlife Service-CRFP Total | \$ 45,600 |
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| Funding for field assistance from NMDG&F | \$ 2,000 |
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| PIT Tags (5,000 tags) | <u>\$ 20,000</u> |
|-----------------------|------------------|

| | |
|--------------------|------------------|
| GRAND TOTAL | \$ 67,600 |
|--------------------|------------------|

Previous Years' Funding:

| | |
|------------------|---|
| Fiscal Year 1997 | \$41,200 |
| Fiscal Year 1998 | \$44,000 |
| Fiscal Year 1999 | \$50,700 |
| Fiscal Year 2000 | \$86,240 (includes cost of purchasing large number of PIT tags) |
| Fiscal Year 2001 | \$62,600 |

Estimated Outyear Funding:

| | |
|------------------|----------|
| Fiscal Year 2003 | \$69,630 |
| Fiscal Year 2004 | \$69,840 |
| Fiscal Year 2005 | \$71,940 |
| Fiscal Year 2006 | \$74,100 |
| Fiscal Year 2007 | \$76,330 |

Augmentation and Monitoring of Colorado Pikeminnow in the San Juan River Fiscal Year 2002 Project Proposal

Principal Investigator: Dale Ryden and Frank Pfeifer
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Background:

Colorado pikeminnow is a federally-listed endangered fish native to the San Juan River. The capture of low numbers of Colorado pikeminnow of all life stages over the past ten years has confirmed that a small, but reproducing population of Colorado pikeminnow still exists in the San Juan. In 1996, experimental stocking of Colorado pikeminnow into the San Juan River was undertaken by the Utah Division of Wildlife Resources. The purpose of this effort was to evaluate dispersal and retention of stocked juvenile Colorado pikeminnow as well as determining the availability, use, and selection of habitats critical to early life stage Colorado pikeminnow. Between 1996 and 2000, approximately 827,000 larval and age-0 Colorado pikeminnow were stocked into the San Juan River. To date, several hundred experimentally stocked fish have been recaptured during either seining or electrofishing efforts. Based on data collected from these experimentally stocked fish, it is apparent that stocked, hatchery-reared, juvenile Colorado pikeminnow can survive in the San Juan River and can provide a viable method of supplementing the numbers and expanding the range of the wild San Juan River Colorado pikeminnow population.

The need for artificial propagation and augmentation of this species in the San Juan River is apparent for several reasons. Augmentation of Colorado pikeminnow would increase population numbers, provide more individuals for research purposes, add genetic diversity to the existing gene pool, and provide a riverine refugia population that would, hopefully, remain stable until further research can identify factors limiting successful recruitment of these species in the San Juan River. The San Juan River Long Range Plan identifies the need to assess the feasibility of, and then implement the augmentation of Colorado pikeminnow. Development of an augmentation plan for this species in the San Juan River will provide the necessary guidance for augmentation efforts as well as directly fulfilling objective 5.3.8.2 of the San Juan River Long Range Plan.

Objectives:

- 1.) Procure and stock fish according to guidelines set out in the augmentation plan for Colorado pikeminnow in the San Juan River
- 2.) Track adult Colorado pikeminnow implanted with radio transmitters to determine survival, dispersal, habitat use, and possible spawning behavior.

Methods:

Objective 1: Young Colorado pikeminnow will be reared in grow-out ponds until late October or early November, at which time they will be harvested and stocked into the San Juan River at locations specified in the augmentation plan. Monitoring of stocked early life stage Colorado pikeminnow will be performed on trips for monitoring of stocked razorback sucker and during standardized fall monitoring trips.

Objective 2: On 11 April 2001, 148 adult Colorado pikeminnow were stocked into the San Juan River at RM 178.8. These fish averaged 539 mm TL. Eight of these adult fish were equipped with four-year life-span radio transmitters. These fish will be tracked about once a month to determine survival, dispersal, habitat use, and possible spawning behavior. If spawning activities are observed, more frequent tracking will be performed. Detailed information on habitat use and water quality will be taken at contact locations. Attempt may be made to recapture the fish (at researcher's discretion) to determine health, get age/growth information, and determine reproductive status.

Products:

An interim progress report detailing the field activities performed in 2002 will be produced by 30 March 2003. A "draft final" of this report, incorporating all comments received will be completed by 1 June 2003.

Budget FY - 2002:

Personnel

| | |
|--|------------------|
| Objective 1 (5 man days): pond work and stocking | \$ 1,032 |
| Objective 2 (120 man days): radio-tracking | <u>\$ 24,628</u> |
| Subtotal | \$ 25,660 |

Travel and Per Diem (58 days) \$ 11,840

Equipment and Supplies--i.e., maintenance, repair, replacement of:

Field equipment: stocking truck, water pump, nets, PIT tag gear,
rafts and jon boats, outboard motors, radio receivers, etc. \$ 3,000

Total \$ 40,500

Service Administrative Overhead (20.00%) \$ 8,100

GRAND TOTAL \$ 48,600

Previous Years' Funding:

None (effort not previously undertaken)

Estimated Outyear Funding:

| | |
|------------------|----------|
| Fiscal Year 2003 | \$50,100 |
| Fiscal Year 2004 | \$51,600 |
| Fiscal Year 2005 | \$53,200 |
| Fiscal Year 2006 | \$54,800 |
| Fiscal Year 2007 | \$56,500 |
| Fiscal Year 2008 | \$58,200 |
| Fiscal Year 2009 | \$60,000 |

**Colorado Pikeminnow Fingerling Production
Fiscal Year 2002 Project Proposal**

Principal Investigator - Roger L. Hamman
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Background:

Dexter NFH & TC has been involved with the culture of Colorado pikeminnow (Ptychocheilus lucius) since 1981. The major emphasis has been on the reproductive biology, broodstock development and culturing fry, fingerlings and adults. This workplan proposes to produce 200,000 fingerlings (50mm TL) for stocking in the San Juan River during fiscal year 2002.

Stocking will require coordination with New Mexico FRO, Region 6 - Grand Junction, CO and New Mexico Game and Fish Department.

Objectives:

Produce 200,000 fingerlings (50mm TL) for stocking in the San Juan River during October 2002.

Methods:

Broodstock will consist of 400+ (F1) adults. These fish are 1991 year-class progeny from wild adults collected from the Colorado River. A maximum of 30 paired matings (1 female X 1 male) will be spawned during 2001. Given the past history of hormonal induced ovulation, 22-23 females (75%) should produce viable eggs during a given year. All members of the broodstock are PIT tagged and records of spawning pairs will be maintained.

Ovulation will be induced with intraperitoneal injections of common carp pituitary (CCP) at the rate of 4 mg/kg of body weight. When eggs can be expelled using slight pressure, a female will be stripped and milt added from one male. Each individual egg lot will be enumerated and kept separate in Heath trays until hatching occurs, about 96 hours after fertilization.

When eggs begin hatching, fry will be transferred to hatchery tanks and held until swim-up occurs, approximately five to seven days. Fry will be enumerated and stocked into two earthen ponds ranging from .33 to .35 ha. Fry will be cultured in earthen ponds for about 120 days. Fingerlings (50mm TL) will then be available for stocking in the San Juan River during October, 2002.

Budget FY - 2002:

Personnel requirement:

- Drain broodstock pond and transferring adults to fish culture building
- Inject males and females with hormones
- Prepare egg hatching system
- Spawn broodstock and return to holding pond
- Place eggs in hatching system and care for eggs
- Prepare holding tanks for fry
- Transfer fry from incubators to holding tanks
- Prepare ponds for fry
- Pond management
- Transfer swim-up fry from holding tanks to ponds
- Daily feeding (including weekends & holidays)
- Weekly dissolved oxygen, temperature and pH recordings
- Drain fingerling ponds and transfer to fish culture building
- Prepare holding tanks for fingerlings
- Inventory (weights and numbers) for each pond
- Treat fish for parasites if required and/or needed

| | |
|----------|-----------|
| Subtotal | \$ 10,250 |
|----------|-----------|

Equipment and Supplies:

| | |
|---|-------|
| Hormones for spawning | 250 |
| Liquid oxygen & compressed oxygen costs | 250 |
| Heating water for hatching eggs (natural gas) | 500 |
| Heating water for fry to swim-up (natural gas) | 500 |
| Water quality monitoring equipment | 1,000 |
| Culture equipment (nets, seines, screens, etc.) | 1,000 |
| Pond management supplies | 1,000 |
| Pumping costs (electrical) | 5,000 |
| Fish feed | 1,000 |
| Maintenance costs for equipment | 1,500 |

| | |
|----------|-----------|
| Subtotal | \$ 12,000 |
|----------|-----------|

Reintroduction Costs:

| | |
|-------------------|-----|
| Salaries | 700 |
| Overtime | 250 |
| Per Diem | 250 |
| Fuel Cost | 150 |
| Truck Maintenance | 150 |

| | |
|----------|----------|
| Subtotal | \$ 1,500 |
|----------|----------|

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|---------------------------------------|-----------|
| Total | \$ 23,750 |
| Service Administrative Overhead (20%) | 4,750 |

| | |
|--------------------|------------------|
| Grand Total | \$ 28,500 |
|--------------------|------------------|

**Maintenance of an Interim Holding Facility for Larval Razorback Sucker
Fiscal Year 2002 Project Proposal**

Principal Investigator: Steven P. Platania
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Background:

The Five-Year Augmentation Plan for Razorback Sucker in the San Juan River, completed and approved in August 1997, provided guidance for re-establishment of this endangered native fish in the San Juan River. The augmentation plan recommended the stocking of 31,800 razorback sucker into the San Juan River during Year 1. However, between 3 September 1997 and 15 October 1998 a total of only 4,164 razorback sucker (progeny from adults from either Lake Mohave, Green River, and the San Juan River arm of Lake Powell) have been stocked in the San Juan River (Table 1).

Table 1. Summary of San Juan River razorback sucker stocking efforts.

| DATE | NUMBER | SIZE | RELEASE LOCATION | PARENTAL STOCK |
|-------------------|-----------------------------------|----------|----------------------|---------------------------|
| 3 SEP 1997 | 1,027 | JUVENILE | Hogback Diversion | Lake Mohave |
| 17 SEP 1997 | 227 | JUVENILE | Hogback Diversion | Green River |
| 19 SEP 1997 | 1,631 | JUVENILE | Hogback Diversion | SJR Arm of Lake Powell |
| 22 APR 1998 | 124 | JUVENILE | Hogback Diversion | Green River |
| 28 MAY 1998 | (total combined w/22 APR 1998) | JUVENILE | Hogback Diversion | Green River |
| 14-15 OCT 1998 | 1,155 | JUVENILE | Hogback Diversion | Ojo Amarillo Pond |
| TOTAL | 4,164 | | | |

The inability to achieve San Juan River razorback sucker augmentation goals has been due to a suite of circumstances all of which ultimately result in a lack of fish. Rearing facilities outside of the San Juan River Basin lack the capabilities to continue to hold and rear razorback sucker for the San Juan River Recovery Implementation Program (SJR-RIP). Given this lack of resources,

efforts were undertaken to develop and establish rearing facilities (holding ponds) within this basin thereby affording self-sufficiency to the San Juan River razorback sucker augmentation program.

Lake Mohave was initially identified as the best and most cost-effective source for razorback sucker for San Juan River augmentation. Large numbers of larval razorback sucker have been collected in Lake Mohave, over a relatively short period, during March-April (post razorback sucker spawning). Those fish were then transported to Ojo Amarillo and Avocet ponds, rearing ponds located south of Farmington and specifically maintained for razorback sucker.

Unfortunately, water temperatures at Ojo Amarillo and Avocet ponds (during March-April) have been identified as being too low to sustain razorback sucker larvae. In addition, a structural failure in August 1999 at Ojo Amarillo Pond, in combination with lower than expected rates of survival, resulted in the loss of the majority of razorback sucker available for 1999-2000 augmentation. Even with rehabilitation of Ojo Amarillo Pond, the number of razorback sucker currently available to the San Juan River Recovery Implementation Program (SJR-RIP) will not be sufficient to achieve the goals prescribed in the five-year augmentation plan until the issues of low water temperature at holding ponds is resolved.

In 2001, we donated the use of a re-circulating larval fish holding and rearing facility (closed-system) to the program for evaluation of this larval razorback sucker interim holding facility pilot project. This system was selected because it had proved successful in past cyprinid (minnow) rearing projects. The system was able to hold large numbers of individuals and flexible enough to accommodate a range of environmental requirements. In addition, start-up costs for use of the re-circulating larval fish holding was minimal. In FY 2001, the San Juan River Research Program provided funds for maintenance of the closed-system, specimen rearing, personnel costs, and transportation.

We received about 32,000 larval razorback sucker from Dexter National Fish Hatchery and Technology Center on 28 March 2001 and about 20,000 larvae on 11 April 2001 from Willow Beach National Fish Hatchery. As of 30 April 2001, we estimate a survival rate exceeding 95% of the stock received. Most of the Dexter larval razorback sucker had achieved the juvenile developmental stage and are about 15 mm TL (as of 30 April 2001). Larval razorback sucker from Willow Beach, which are about two weeks younger than those from Dexter, had progressed to the metalarval stage and are about 12 mm TL (as of 30 April 2001).

On 16 May 2001, all larval razorback sucker were transported to Farmington for release in Ojo Amarillo and Avocet ponds (water temperature = 21°C). The survival estimate for the fish from the Dexter spawn (originally 32,000) was between 60-65% (19,200 to 20,800). Conversely, the survival rate for fish from Willow Beach (n=21,000) was higher and estimated to be between 75-80% (15,750 to 16,800). The two lots of fish remained separate throughout the duration of rearing.

The reason for the higher survival rate for Willow Beach fish was that they were held for a shorter period, were not reared to the large size of Dexter fish, and were less concentrated during rearing (first two factors were most important). The greatest loss of Dexter fish occurred during

the final two weeks in captivity as those fish exceeded 15 mm TL. They had achieved the juvenile stage of development (for some time) and appeared healthy but for some reason (currently unknown) there was a chronic daily loss of 100-200 individuals. Water quality was not an issue (at least for the parameters being checked) and fish continued to feed up until death.

The 2001 study demonstrated that the closed-system rearing facility was an efficient means for the temporary rearing of large numbers of larval razorback sucker. The facility was designed to maintain larvae in the interim (8-10 weeks) between hatching and a time when water temperatures at Ojo Amarillo and Avocet ponds increases to a level sufficient for rearing of larvae. The success of this project provided a viable source of larval razorback sucker that can be used for the augmentation effort of this species and the goals delineated in the program document.

For FY 2002 and subsequent years (up to FY 2007), the San Juan River Biology Committee is committed to increasing its razorback sucker augmentation abilities. Numerous grow-out ponds are being investigated for development and construction on the Navajo Reservation (San Juan River Biology Committee meeting 16 May 2001 – draft meeting summary). In addition, options regarding establishment of ponds on property of private citizens are also being explored. Regardless of the ultimate distribution of razorback rearing ponds, the need for interim holding facilities has been identified as a critical need to augmentation. The goal (starting in FY 2002) is to rear at least 150,000 larval razorback sucker annually for release to rearing ponds and ultimately introduction to the San Juan River.

The successful and efficient rearing of 150,000 larval razorback sucker will require a one-time designation of funds for construction of (a?) necessary and appropriate interim rearing system. The aquarium system employed in 2000 cannot be modified to accommodate the two-fold increase in number of specimens. In addition, that system did not make the most efficient use of the limited floor-space available for razorback sucker rearing. A completely new aquarium based ?? (again a closed-system) will be developed and constructed in sufficient time to accept the 150,000 larval razorback sucker expected in FY 2002. Costs for purchase of equipment and construction of that system are identified in this proposed budget. In subsequent years (i.e., FY 2003) costs for this project will be reduced as the system will have been completed and will only require funds for maintenance and upkeep (in addition to annual costs associated with rearing, salary, and supplies).

Description of Study Area:

Larval razorback sucker will be obtained from available sources (i.e., Lake Mohave, Willow Beach National Fish Hatchery, Dexter National Fish Hatchery and Technology Center) and transported to interim rearing facilities at the University of New Mexico. The rearing facility will need to be re-configured to hold and rear up to 150,000 larval razorback sucker for a period of between 6-10 weeks. Water temperature information acquired from Ojo Amarillo and Avocet ponds suggest that by mid-May or early-June water temperatures will have achieved a sufficient level to sustain larval razorback sucker. These data indicate that the interim holding facilities should be prepared to accommodate larvae for at least 6 and up to 10 weeks. The goal will not

be to hold larval fish in the interim facility for a pre-determined time period but instead to establish them in the more natural conditions of rearing ponds as soon as conditions allow.

Objectives:

- 1.) Short term rearing of up to 150,000 larval razorback sucker available from various sources.
- 2.) Transfer reared larval razorback sucker to rearing ponds.
- 3.) Continued assessment of success of interim rearing effort.

Methods:

Members of the U.S. Fish and Wildlife Service's Colorado River Fishery Project Office in Grand Junction (CRFP-GJ), Colorado will coordinate the distribution of larval razorback sucker during March and April and spawning of brood stock adult razorback sucker at Willow Beach National Fish Hatchery and Dexter National Fish Hatchery and Technology Center (or other appropriate facilities). Larval razorback sucker (ca. "swim-up" stage) will be transferred to the MSB rearing facility with handling and transportation following existing U. S. Fish and Wildlife Service protocols. Growth and survival will be tracked during the rearing tenure at MSB. Personnel from CRFP-GJ will determine when it is appropriate to transfer larval razorback sucker from the interim MSB holding facilities to Ojo Amarillo and Avocet ponds (presumably May to June). This transfer and disposition of larvae will be determined and coordinated by CRFP-GJ with the assistance of MSB personnel.

Products:

A draft report assessing the success of the 2002 razorback sucker interim holding facilities will be prepared and distributed by 31 March 2003. That report will include information on the different stocks of larval razorback sucker holding facility success. Upon receipt of written comments, that report will be finalized and disseminated to members of the San Juan River Biology Committee by 1 June 2003. An electronic spreadsheet containing information from the project will also be submitted in accordance with the aforementioned schedule. Voucher series of fish collected from this study will be curated in the Division of Fishes, Museum of Southwestern Biology (MSB), Department of Biology, at the University of New Mexico.

Budget FY-2002:**Construction of Rearing System (FY- 2002):**

| | | | |
|--|--|-----------|---------------|
| <i>System Materials</i> | | | |
| | Acrylic Aquarium Tanks (180 gallon) x 24 | \$ | 16,200 |
| | Acrylic sump tanks (300 gallon) x 3 | \$ | 3,000 |
| | Ultraviolet Sterilization (x 3) | \$ | 2,900 |
| | Pumps (x 3) | \$ | 1,200 |
| | PVC plumbing supplies/fittings | \$ | 700 |
| | Filtering systems (x 3) | \$ | 1,500 |
| | Lumber | \$ | 750 |
| | Subtotal | \$ | 26,500 |
| <i>System Construction Personnel</i> | | | |
| | Research Assistant (12 man-days) (facility design and construction) | \$ | 3,000 |
| | Technician (10 man-days) (construction assistance) | \$ | 1,500 |
| | Subtotal | \$ | 4,500 |
| | Total | \$ | 31,000 |
| | Administrative Overhead | \$ | 4,650 |
| Grand Total | | \$ | 35,650 |

(Budget continued on next page.)

Rearing and Maintenance of System (FY 2002):

| | | | |
|------------------------|---|----|--------|
| Personnel | | | |
| | Laboratory Rearing (35 man-days) (system management, disease control, feeding, supervision) | \$ | 10,500 |
| Travel and per diem | | | |
| | Travel and per diem (acquiring and stocking fish; attending meetings) | \$ | 1,000 |
| | Shipping supplies and costs (for specimens) | \$ | 500 |
| Equipment and Supplies | | | |
| | Larval fish food | \$ | 1,000 |
| | Miscellaneous supplies (for rearing system) | \$ | 1,500 |
| | Total | \$ | 14,500 |
| | Administrative Overhead | \$ | 2,175 |
| Grand Total | | \$ | 16,675 |

Cumulative Costs for Construction and Rearing (FY 2002):

| | | |
|-----------------------------------|----|--------|
| Construction of Rearing System | \$ | 31,000 |
| Rearing and Maintenance of System | \$ | 14,500 |
| Subtotal | \$ | 45,500 |
| Administrative Overhead | \$ | 6,825 |
| Grand Total | \$ | 52,325 |

Outyear Funding (based on 5% annual cost of living increases):

| | |
|------------------|------------|
| Fiscal Year 2001 | \$ 13,800 |
| Fiscal Year 2002 | \$ 52,325* |
| Fiscal Year 2003 | \$ 15,225 |
| Fiscal Year 2004 | \$ 15,986 |
| Fiscal Year 2005 | \$ 16,785 |
| Fiscal Year 2006 | \$ 17,624 |
| Fiscal Year 2007 | \$ 18,505 |

* includes both rearing/maintenance costs and system construction costs. Subsequent outyear budgets (2003-2007) are based on FY 2002 rearing and maintenance costs of \$14,500.